BIOCHEMISTRY, BS

Contact

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Faculty

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Program Description

Biochemistry is the study of the molecular basis of life. Lying at the interface between chemistry and biology, biochemistry is concerned with the structure and interaction of proteins, nucleic acids, and other biomolecules as related to their function in biological systems. As one of the most dynamic areas of science, biochemistry has led to improved medicines and diagnostic agents, new ways of controlling disease, and greater understanding of the chemical factors that control our general health and well-being.

The bachelor of science degree in biochemistry is appropriate for students pursuing advanced degrees in biochemistry, molecular biology, and biophysics, as well as in the biomedical fields and health professions.

Additional Information

For further information, contact the biochemistry major advisors:

James Hougland, 454 Life Sciences Complex, 315-443-1134, hougland@syr.edu; Roy Welch, 234 Life Sciences Complex, 315-443-2159, rowelch@syr.edu; or Carlos Castaneda, 240 Life Sciences Complex, 315-443-3673, cacastan@syr.edu.

Student Learning Outcomes

1. Be able to recognize theories, concepts, and principles from the major sub-fields of biology
2. Be able to recognize theories, concepts, and principles from the major sub-fields of chemistry with emphasis on developing problem solving skills in inorganic and organic chemistry
3. Distinguish more specific and advanced concepts in selected areas of biology and/or chemistry
4. Be able to recognize fundamental biochemical concepts and principles and apply them to problem solving in biochemistry
5. Perform accurate and precise biochemical measurements and be able to apply skills in the nature and practice of science, with emphasis on interpretation of experimental results and drawing reasonable conclusions
6. Communicate effectively through oral and written reports
7. Perform laboratory research

BS Degree Requirements

To Declare the BS Major in Biochemistry

Students declared in the Biochemistry BS program earning less than a C+ in the following courses will be placed on "Major Probation".

1. CHE 106 General Chemistry Lecture I or CHE 109 General Chemistry Lecture I (Honors and Majors)
2. and BIO 121 General Biology I
3. and CHE 275 Organic Chemistry I
4. and BIO 322 Cell and Molecular Biology

Students on “major probation” must successfully pass the following courses with higher than a C+ in their next attempt of the respective course:

1. CHE 106 or CHE 109
2. and BIO 121
3. and CHE 275
4. and BIO 322

Failure to complete the respective course on the second attempt with a grade greater than C+ will result in “Major suspension.” Students in the category of Major suspension will be required to change their major with the college.

Code	Title	Credits
Core Courses		
BIO 121	General Biology I	3
BIO 122	General Biology I Laboratory (or Advanced Placement Biology Credit for BIO 121/BIO 122)	1
Select one of the following:		4
CHE 106 & CHE 107	General Chemistry Lecture I and General Chemistry Laboratory I	
CHE 109 & CHE 129	General Chemistry Lecture I (Honors and Majors) and General Chemistry Laboratory I (Honors and Majors)	
Select one of the following:		4
CHE 116 & CHE 117	General Chemistry Lecture II and General Chemistry Laboratory II	
CHE 119 & CHE 139	General Chemistry Lecture II (Honors and Majors) and General Chemistry Laboratory II (Honors and Majors)	
CHE 275 & CHE 276	Organic Chemistry I and Organic Chemistry I Laboratory	5
CHE 325 & CHE 326	Organic Chemistry II and Organic Chemistry II Laboratory	5
CHE 474	Structural and Physical Biochemistry	3
MAT 285	Life Sciences Calculus I	3
or MAT 295	Calculus I	
MAT 286	Life Sciences Calculus II	3
or MAT 296	Calculus II	
PHY 211 & PHY 221	General Physics I and General Physics Laboratory I	4
PHY 212 & PHY 222	General Physics II and General Physics Laboratory II	4
BIO 322	Cell and Molecular Biology	4
BIO 224	Integrative Biology Laboratory	2

BIO 326	Genetics	3
BIO/BCM 478	Biochemistry Laboratory	3
or BCM 477	Proteins and Nucleic Acids Lab	
BCM 475	Biochemistry I	3
BCM 476	Biochemistry II	3
Upper-Division Elective Courses		
Select at least 12 credits, including at least one instructional lab indicated with an asterisk		12
BCM 460	Research in Biochemistry	
BCM 484	Biomolecular Modeling (w/lab)	
BIO 409	General Microbiology	
BIO 410	General Microbiology Laboratory (*)	
BIO 414	Brain & Behavioral Plasticity	
BIO 422	Bioinformatics for Life Scientists (*)	
BIO 447	Basic Immunology	
BIO 449	Biotechnology Lab (*)	
BIO 457	Principles of Human Toxicology	
BIO 462	Molecular Genetics	
BIO 463	Molecular Biotechnology	
BIO 464	Applied Biotechnology (*)	
BIO 465	Molecular Biology Laboratory (*)	
BIO 471	Cell and Developmental Biology Laboratory (*)	
BIO 501	Biology of Cancer	
BIO 503	Developmental Biology	
CHE 335	Chemical and Biochemical Analysis with Laboratory (*)	
CHE 346	Physical Chemistry I	
CHE 347	Physical-Analytical Chem Lab (*)	
CHE 356	Physical Chemistry II	
CHE 412	Metals in Medicine	
CHE 414	Introduction to Medicinal Chemistry	
CHE 427	Organic Chemistry of Biological Molecules	
CHE 546	Molecular Spectroscopy and Structure	
CHE 575	Organic Spectroscopy	
FSC 441	Forensic Analysis of Biological Evidence with lab	3
Total Credits		**72**

Additional Information

If both BIO 478 Biochemistry Laboratory/BCM 478 Biochemistry Laboratory and CHE 477 Proteins and Nucleic Acids Lab/BCM 477 Proteins and Nucleic Acids Lab are taken, one may count toward the 12-credit elective requirement, thereby also meeting the instructional lab requirement.

BCM 460 Research in Biochemistry counts once (up to 3 credits) toward the elective requirement but does not count as an instructional lab course.

Recommended Electives

For a Career in Biology, Biochemistry, or Molecular Biology

Preparation for Graduate School in a Department of Biology, Biochemistry, or Molecular Biology

Code	Title	Credits
BCM 460	Research in Biochemistry	1-3
BCM 484	Biomolecular Modeling (w/lab)	3
BIO 409 & BIO 410	General Microbiology and General Microbiology Laboratory	4
BIO 414	Brain & Behavioral Plasticity	3
BIO 447	Basic Immunology	3
BIO 457	Principles of Human Toxicology	3
BIO 462	Molecular Genetics	3
BIO 463	Molecular Biotechnology	4
BIO 464	Applied Biotechnology	4
BIO 465	Molecular Biology Laboratory	3
BIO 501	Biology of Cancer	3
BIO 503	Developmental Biology	3
CHE 412	Metals in Medicine	3
CHE 427	Organic Chemistry of Biological Molecules	3

For a Career in Chemistry

Preparation for Graduate School in a Department of Chemistry

Code	Title	Credits
BCM 460	Research in Biochemistry	1-3
BCM 484	Biomolecular Modeling	3
BIO 465	Molecular Biology Laboratory	3
CHE 335	Chemical and Biochemical Analysis with Laboratory	4
CHE 346	Physical Chemistry I	3
CHE 347	Physical-Analytical Chem Lab	2
CHE 356	Physical Chemistry II	3
CHE 412	Metals in Medicine	3
CHE 414	Introduction to Medicinal Chemistry	3
CHE 427	Organic Chemistry of Biological Molecules	3
CHE 546	Molecular Spectroscopy and Structure	1-9
CHE 575	Organic Spectroscopy	3

For a Career in Health Professions (M.D., D.D.S., D.V.M.)

Preparation for Health Professions (M.D., D.D.S., D.V.M.)

Code	Title	Credits
BCM 460	Research in Biochemistry	1-3
BIO 409 & BIO 410	General Microbiology and General Microbiology Laboratory	4
BIO 447	Basic Immunology	3
BIO 457	Principles of Human Toxicology	3
BIO 462	Molecular Genetics	3
BIO 465	Molecular Biology Laboratory	3
BIO 501	Biology of Cancer	3
BIO 503	Developmental Biology	3
CHE 412	Metals in Medicine	3
CHE 414	Introduction to Medicinal Chemistry	3

For a Technical Career in Pharmaceutical or Biotechnology Industry

Preparation for Technical Careers in Pharmaceutical or Biotechnology Industry

Code	Title	Credits
BCM 460	Research in Biochemistry	1-3
BCM 484	Biomolecular Modeling (w/lab)	3
BIO 409 & BIO 410	General Microbiology and General Microbiology Laboratory	4
BIO 447	Basic Immunology	3
BIO 462	Molecular Genetics	3
BIO 463	Molecular Biotechnology	4
BIO 464	Applied Biotechnology	4
BIO 465	Molecular Biology Laboratory	3
BIO 501	Biology of Cancer	3
BIO 503	Developmental Biology	3
CHE 335	Chemical and Biochemical Analysis with Laboratory	4
CHE 347	Physical-Analytical Chem Lab	2
CHE 412	Metals in Medicine	3
CHE 414	Introduction to Medicinal Chemistry	3
CHE 427	Organic Chemistry of Biological Molecules	3
CHE 575	Organic Spectroscopy	3

Distinction in Biochemistry

The biochemistry B.S. program encourages all of its students to participate in research through its BCM 460 Research in Biochemistry course. For students whose research culminates in a written thesis, it is possible to graduate with Distinction in Biochemistry if the following requirements are met.

First, the student must have an overall cumulative GPA of 3.4 and a minimum cumulative GPA of 3.4 in all natural sciences and mathematics courses taken at Syracuse University.

Second, the student must have taken a minimum of 6 credits of BCM 460 Research in Biochemistry

Third, before completion of the final semester at Syracuse University, the student must make an oral presentation (either poster or platform) on his/her research at one of the following:

1. Syracuse University's Annual Life Sciences Undergraduate Research Conference in April; or
2. an external conference sponsored by an outside (non-S.U.) educational institution with its own accredited 4-year biochemistry degree program; or
3. an external conference sponsored by a nationally-recognized scientific society with a biochemistry component (e.g., ACS, FASEB, Biophysical Society).

A symposium specifically designed for undergraduate researchers from multiple institutions and sponsored by a regional or local chapter of a national scientific society does qualify as external, even if it is physically located at Syracuse University.

Fourth, the written thesis must be judged by a committee of readers selected from among the biochemistry program faculty listed in the Syracuse University Course Catalog. The student is responsible for selecting potential readers and obtaining their consent. The committee of readers should include the research supervisor, but in any case, must include at least one member whose primary appointment is in the Biology Department, and one member whose primary appointment is in the Chemistry Department.

College of Arts and Sciences Requirements

For all Arts and Sciences|Maxwell students, successful completion of a bachelor's degree in this major requires a minimum of 120 credits, 96 of which must be Arts and Sciences|Maxwell credits, completion of the Liberal Arts Core (https://coursecatalog.syracuse.edu/undergraduate/arts-sciences/#text) requirements, and the requirements for this major (30 credits) that are listed above.

Dual Enrollments:

Students dually enrolled in **Newhouse*** and Arts and Sciences|Maxwell will complete a minimum of 122 credits, with at least 90 credits in Arts and Sciences|Maxwell coursework and an Arts and Sciences|Maxwell major.

*Students dually enrolled in the College of Arts and Sciences|Maxwell as first year students must complete the Liberal Arts Core (https://coursecatalog.syracuse.edu/undergraduate/arts-sciences/#text). Students who transfer to the dual program after their first year as singly enrolled students in the Newhouse School will satisfy general requirements for the dual degree program by completing the Newhouse Core Requirements.

Undergraduate University Requirements

The following requirements and experiences apply to all Syracuse University Undergraduate matriculated degree programs.

- IDEA Course Requirement (https://coursecatalog.syracuse.edu/undergraduate/idea-course-requirement/)
- First Year Seminar (https://coursecatalog.syracuse.edu/undergraduate/courses/fys/)